TITLE OF THE INVENTION.

Extended multicast information broadcasting method, system and corresponding software product

CROSS-REFERENCE TO RELATED APPLICATIONS.

The present application claims priority to and incorporates by reference PCT/FR2004/002074 filed August 2, 2004 and French Application No. 0309873 filed August 12, 2003.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.

None.

THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT.

None.

INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC

None.

BACKGROUND OF THE INVENTION.

Field of the Invention.

The invention relates to an extended multicast information broadcasting method, a system and corresponding software products.

Description of Related Art

At the present time, businesses or industrial or commercial companies are virtually compelled to transfer data and information supported by this data via the IP network.

Most commonly, these businesses or companies are multi-establishment entities, with one or more establishments normally being associated with at least one website, these sites being interlinked via an IP network. These businesses or companies are therefore also multi-site entities.

As a general rule, the IP multicast information broadcasting process can be used for information broadcasts on each of the abovementioned sites.

However, the abovementioned broadcasts are said to be "private", because they are limited and restricted to users of fixed or roaming terminals identified as belonging to the site, but cannot in any way be transmitted from one site to another.

This type of broadcast is, for this reason, called a broadcast local to the site.

A review of the unicast and multicast broadcasting techniques is given first of all below, in conjunction with the figures.

With reference to figure 1a, the unicast broadcasting technique currently used on the IP network supports point-to-point broadcasts.

A broadcast server SD generates a flow of data to each of the terminals (receivers) R_1 to R_7, for which it has received a request via routers RO_0 to RO_{10}.

The more receivers there are, the more the SD server is polled and the more network bandwidth is used to transmit identical data and information.

In the case of the multicast broadcasting technique, however, with reference to figures 1b and 1c, a

receiver, R_6, wishing to have access or subscribe to a multicast broadcast sends an access request to its access router RO_6, according to the IGMP method (RFC 2236). The access router RO_6 uses a multicast routing protocol, the PIM-SM method (RFC 2117) for example, to relay this request to a point in the network (switching point or router) that is already receiving this broadcast, possibly directly to the access router RO_0 of the broadcasting source, as is represented in figure 1b. The route of the abovementioned request is represented by solid line arrows in figure 1b.

Each router belonging to the path keeps in memory the software interface, the routing address data, via which it has received a request to subscribe to a determined broadcast. When the router concerned receives the IP data packets relating to this broadcast, it transmits them to its adjacent router by reverse path, via the stored software interface.

Thus, the IP data packets corresponding to this broadcast reach the requesting receiver R_6 by reverse path. The reverse path is represented by broken line arrows in figure 1b.

When a new receiver, receiver R_1 for example as represented in figure 1b, wants to access this same broadcast, it sends its access request to its access router RO_4. The latter transmits this request until it reaches a router executing the requested broadcast, in this case the router RO_2 in figure 1b. The path of this request is represented by alternating solid and broken line arrows in figure 1b.

The router that is furthest forward, in the broadcast direction, reached by this request, which is already receiving the broadcast data and information requested

by the receiver R_1, stops this request from being returned to the broadcasting source, the server SD, duplicates the IP data packets to transmit the latter also to the receiver R_1 via the stored software interface, by reverse path. The path of the complete broadcast is represented by broken line arrows in figure 1b, the reverse path RO_2 – RO_3 – RO_4 – R_1 being represented by double broken line arrows, although belonging to the same multicast broadcast as that requested by the receiver R_6. The same applies for any other receiver R_2 to R_5 likely to request the same broadcast.

Consequently, with the IP multicast broadcasting technique, it can be seen that the server SD sends the data supporting the information forming the broadcast only once. This data is duplicated by the routers of the network dynamically, to reach the authorized receivers that have requested it. The set of routes or paths taken by the IP data packets of the broadcast, from the server SD to these authorized receivers, forms a multicast information broadcast tree, the root of which is the broadcasting source, server SD or root router RO_0, the various paths forming the branches and the terminal receivers forming the leaves. It will be understood, in particular, that, following the access request from the receivers R_6 and R_1, in the case of an access request from the receiver R_4, the branch RO_2 – RO_9 and receiver leaf R_4 are added whereas in the case of an access request from the receiver R_2, only the receiver leaf R_2 is added.

Regarding the IP multicast addressing, the multicast broadcasting technique introduces the concept of multicast broadcast. An IP data packet that is part of a multicast broadcast has a destination IP address, called a multicast address. All the data packets supporting information belonging to one and the same

broadcast have the same destination multicast address. Whereas a unicast IP address is used to identify only a single receiving machine or terminal, a multicast IP address is used to identify a set or group of machines, the set of authorized machines with access to this broadcast. A multicast address is therefore always a destination address and is pointless as a source address. To this end, a portion of the IP address codes is reserved for the assignment of multicast addresses.

Specifically, the RFC 2365 standard (Administratively Scoped IP Multicast) defines a way of assigning to certain multicast addresses an administrative limit on the broadcast that these addresses represent.

Depending on the value of the multicast address assigned to a broadcast, this broadcast is consequently intended to be limited:
- to a site ("site-local scope");
- to an organization ("organization-local scope");
- to the entire Internet ("global scope").

The data supporting an information broadcast limited to a site, "site-local scope", must not cross the administrative limits that are imposed on it by its multicast address. To this end, each administrative entity is responsible for the configuration of its routers so as to handle the translation, in terms of network configuration on this site, of abovementioned administrative rules and compliance with the latter.

The possibilities offered by the abovementioned multicast broadcast concept with a view to the broadcasting of data to the different sites of a multi-site business or entity at the present time appear to be substantially limited.

If, with reference to figure 1c, we assume a multi-site entity located on four separate sites, site 1, site 2, site 3 and site 4, site 1 for example including a multicast broadcast server SD, such a broadcast, according to a "site-local scope" mode, is local to the site 1. Consequently, the IP data packets supporting the information of this broadcast are not transmitted outside the site. These data packets do not therefore pass through the interconnecting network and cannot be received by the users of the other sites, site 2, site 3, site 4.

One possibility could be, where appropriate, to implement a unicast IP tunnel between the site site 1, the originating site, and each of the users, in particular the roaming users connected to the other sites, site 2, site 3 and site 4.

Although an appropriate signaling can be used to allow the routing of requests to access the broadcast, respectively of the data packets supporting the information of this broadcast by reverse path via each of the unicast IP tunnels, the drawbacks generated by such a solution are as follows:

- loss of all the benefits associated with the multicast broadcast over the network interconnecting the sites, precisely because of the creation of substitute unicast IP tunnels;

- scaling problem: the more requesting users there are, the more it is necessary to create unicast tunnels, and the more, consequently, the access router RO_0 of the site site 1 has to duplicate the IP packets supporting the information of the broadcast and the more the bandwidth on the interconnecting network is used to transmit the same data packets multiple times. Such a method is therefore analyzed, from the point of view of

the bandwidth consumption of the connecting network, as a simple multiplication of point-to-point connections, which consequently limits the number of simultaneous requesting users on all the sites of the multi-site entity.

BRIEF SUMMARY OF THE INVENTION

The object of the present invention is to overcome the drawbacks of the possibilities directly deriving from the conventional multicast broadcast and the connection by unicast IP tunnel, by recognizing the intrinsic potential of multicast broadcasting over the network interconnecting the multiple sites of a multi-site entity or business, in order to allow the broadcasts local to any site to be broadcast to the requesting users, such as the roaming users belonging to this site and visiting other sites of the multi-site entity, while avoiding the creation of multiple unicast IP tunnels.

Another object of the present invention is, furthermore, to avoid any duplicating of the data packets supporting the information of the broadcast in proportion to the number of unicast IP tunnels or users requesting this broadcast on the sites that make up this multi-site entity.

The final object of the present invention is to provide an optimization of the resources of the interconnecting network through the abovementioned absence of duplication, the service for accessing the local broadcast on an originating site still remaining operational whatever the number of requesting users, such as one of the roaming users visiting the separate sites, other than the originating site, that make up the multi-site entity.

The abovementioned objects are achieved, through the implementation of an extended multicast information broadcasting method, based on a multicast information broadcast, a system and corresponding software products, the concept of extended multicast information broadcast corresponding to that of a multicast broadcast that is global, yet limited to the set of sites that make up a multi-site business or entity.

The multicast information broadcasting method extended, from a local multicast broadcast on an originating site to a roaming terminal user belonging to this originating site, to at least one separate site hosting this roaming terminal and linked to this originating site by the IP network, this local multicast information broadcast being generated from an information broadcasting source located at a first local multicast information broadcasting address in this originating site, in accordance with the object of the present invention, is noteworthy in that it consists, after interconnecting this roaming terminal to the IP network on this separate site, in transmitting, from the roaming terminal to the originating site, an extended IP multicast information broadcast request message, this request message containing at least this first local multicast broadcasting address and an identification code of this roaming terminal, and, following the identification of said roaming terminal by this originating site, transmitting from this originating site to this roaming terminal a message offering access to a global multicast information broadcast, this message offering access including at least one second global multicast information broadcasting address, the broadcasting source of which is identified in this originating site, and, following the receipt of this message offering access by this roaming terminal, transmitting from this roaming terminal to the originating site, via the IP

network, a message accepting the offer to access the information being broadcast at this second global multicast information broadcasting address, and, at the originating site, transferring the information to be broadcast from the first to the second address, and transmitting, by global multicast broadcast, the information to be broadcast to the second address.

This enables the roaming terminal interconnected on the separate site to receive, on this separate site, the information being broadcast under the first local broadcasting address, broadcast under the second global broadcasting address.

The multicast information broadcasting system extended, from a local multicast broadcast on an originating site to a roaming terminal user belonging to this originating site, to at least one separate site hosting this roaming terminal and linked to this originating site by the IP network, the local multicast information broadcast being generated, from an information broadcasting source located at a first local multicast broadcasting address in this originating site, in accordance with the object of the present invention, is noteworthy in that it includes at least, at this originating site, a module for receiving an extended IP multicast information broadcast request message, sent by this roaming terminal from this separate site, this request message containing at least this first local multicast information broadcasting address and an identification code of this roaming terminal, this reception module being used for the identification of this roaming terminal by the originating site, a module for transmitting, from the originating site to the roaming terminal, a message offering access to a global multicast information broadcast, this message offering access including at least one second global multicast information broadcasting address, the broadcasting

source of which is identified in the originating site, a module for receiving a message accepting the offer of access to the information being broadcast at this second global multicast information broadcasting address sent by this roaming terminal, a module for transferring the information to be broadcast from the first to the second broadcasting address and a module for the transmission, by global multicast information broadcast, of the information to be broadcast under the second address.

The invention further relates to a roaming terminal equipped to implement the multicast information broadcasting method extended, from a local multicast information broadcast on an originating site, to which this roaming terminal belongs, to at least one separate site hosting this roaming terminal and linked to this originating site by the IP network, from an information broadcasting source located at a first local multicast information broadcasting address in this originating site. This roaming terminal is noteworthy in that it includes at least, stored in the mass memory of the latter, a software module for creating and transmitting an extended IP multicast information broadcast request message, this request message containing at least a first multicast information broadcasting address and an identification code of this roaming terminal, a software module for receiving and reading a message offering access to a global multicast information broadcast, this message offering access including at least one second global multicast information broadcasting address, the broadcasting source of which is identified in the originating site and a software module for creating and transmitting to this originating site via the IP network, a message accepting the offer of access to the information being broadcast at this second global multicast information broadcasting address.

The extended multicast information broadcasting method and system that are the subject of the present invention find application in the management of and controlled access to local and global multicast information broadcasts between the various sites of establishments or multi-site businesses interconnected by the IP network.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

They will be better understood from reading the description and looking at the drawings below, in which, apart from figures 1a to 1c concerning the prior art of the unicast and multicast information broadcasting techniques:

- figure 2a represents, by way of illustration, a flow diagram of the main steps in implementing the extended multicast information broadcasting method, according to the object of the present invention;

- figure 2b represents, purely by way of illustration, a specific and non-limiting implementation of the step for transferring the information to be broadcast from the first local broadcasting address to the second global broadcasting address;

- figure 2c represents, purely by way of illustration, a preferred and non-limiting implementation of the method that is the subject of the present invention for a number of extended IP multicast information broadcast request messages greater than one and relating to one and the same local multicast information broadcast from one and the same originating site;

- figures 3a to 3c represent, purely by way of illustration, an example of the structure respectively

of the information broadcast request, information broadcast access offer and extended multicast access offer acceptance messages;

- figures 4a, 4b and 4c represent, purely by way of illustration, an extended multicast information broadcasting system, in accordance with the subject of the present invention, according to a plurality of successive situations corresponding to the sending of successive extended multicast information broadcast request messages from one or more roaming terminals from different sites of a multi-site business;

- figure 5 represents, by way of illustration, an example of implementation of a roaming terminal according to a non-limiting embodiment.

DETAILED DESCRIPTION OF THE INVENTION

The multicast information broadcasting method extended, from a local multicast information broadcast on an originating site to a roaming terminal user belonging to that originating site, to at least one separate site hosting this roaming terminal and linked to this originating site by the IP network, in accordance with the subject of the present invention, will now be described in conjunction with figure 2a and the following figures.

As a general rule, it should be remembered that the local multicast information broadcast denoted LMD_{oi} is generated from an information broadcasting source SD intended for a first local multicast information broadcasting address in this originating site.

With reference to figure 2a, the local multicast information broadcast is designated LMD_{oi}, in which the references 0 and i represent the first local multicast

information broadcasting address in this originating site, the reference 0 designating the address of the originating site S_0 and the reference i designating the address of the local multicast information broadcast concerned in the abovementioned originating site. The local multicast information broadcast can be given equivalent status to the first broadcasting address.

A set of separate sites $\{S_k\}$, k=1 to k=N, is also considered, the originating site S_0 and each of the sites S_k forming the multi-site entity or business mentioned previously in the description.

Finally, there is assumed a roaming terminal denoted N_{0jk}, the index 0 indicating a reference to the effect that this roaming terminal belongs to the originating site S_0, the reference j denoting a reference or identification code of the roaming terminal concerned and the reference k denoting the connection of the roaming terminal concerned to the separate site S_k hosting the latter and the link from the roaming terminal concerned to the originating site via the IP network.

With reference to figure 2a, the method that is the subject of the invention consists, via the interconnection of the roaming terminal to the IP network, in transmitting, in a step A, from the roaming terminal N_{0jk} to the originating site S_0, an extended multicast information broadcast request message, this request message being denoted EMR (LMD_{0i}).

As is indicated in the step A of figure 2a, the abovementioned request message contains at least the first local multicast information broadcasting address LMD_{0i}, and an identification code of the roaming terminal based in particular on the indices 0 and

references j and k of the roaming terminal concerned N_{0jk}.

Following the identification of the roaming terminal by the originating site based on the information contained in the request message, the method that is the subject of the invention consists, in a step B, in transmitting from the originating site S_0 to the roaming terminal N_{0jk}, a message offering access to a global multicast information broadcast, this message offering access being denoted GMO (GMD_{0g}) in figure 2a. The abovementioned message offering access includes at least one second global multicast information broadcasting address GMD_{0g}, the broadcasting source of which is identified in the originating site.

With reference to figure 2a and step B of the latter, it will be understood that the second global multicast information broadcasting address GMD_{0g} includes the reference with the index 0 relating to the originating site and the reference g to a global multicast broadcasting address as defined specifically according to the RFC2365 standard mentioned previously in the description.

Following the receipt of the message offering access GMO (GMD_{0g}) by the roaming terminal N_{0jk}, the method that is the subject of the invention then consists, in a step C, in transmitting from the abovementioned roaming terminal to the originating site S_0 via the IP network, a message accepting the offer of access to the information being broadcast at the second global multicast information broadcasting address.

In the step C of figure 2a, the message accepting the offer of access is denoted AAO (GMD_{0g}).

After receipt of the message accepting the offer of access AAO (GMD_{0g}) at the originating site S_0, the method that is the subject of the invention includes a step D consisting in transferring the information to be broadcast, stored at the first broadcasting address and denoted for this reason ID_{0i}, to the second broadcasting address. The information stored under the second broadcasting address being denoted ID_{0g}.

By this simple operation, the information broadcast according to a local multicast information broadcast on the originating site S_0 can then be broadcast according to an extended multicast information broadcast via the following step E represented in figure 2A.

The abovementioned step E then consists in transmitting, by global multicast broadcast, the information to be broadcast under the second address ID_{0g}. This enables the roaming terminal N_{0jk} interconnected on the separate site to receive on the abovementioned separate site S_k information broadcast under the first local broadcasting address then broadcast under the second global broadcasting address.

With reference to the same figure 2a, it is indicated that the steps A, B and C represented in the latter, concerning the transmission between the roaming terminal N_{0jk} and the originating site S_0 of the extended IP multicast broadcast request message EMR (LMD_{0i}), of the message offering access to a global multicast broadcast GMO (GMD_{0g}) and of the message accepting the offer of access AAO (GMD_{0g}) are executed in point-to-point mode.

The execution of this transmission mode for the abovementioned steps is made possible through the communication of the respective addresses 0 of the originating site or k of the separate site concerned,

the index j or address reference of the roaming terminal possibly then consisting of an identification code of the latter.

However, and according to a noteworthy aspect of the method that is the subject of the present invention, the global multicast transmission step E is performed in point-multipoint mode.

It will be understood, in these conditions, that the process for transmitting information broadcast under the second address, the global multicast transmission in the step E, is then comparable to the one described in conjunction with figure 1b described previously in the description, but that, however, the transmission of the information broadcast under the second global multicast broadcasting address ID_{0g} is no longer performed locally on only the originating site, but also on the or each separate site of the multi-site entity, as will be described in greater detail later in the description.

A particular embodiment of the step D consisting in transferring the information to be broadcast from the first to the second broadcasting address will now be described in conjunction with figure 2b.

The abovementioned embodiment concerns the particular and non-limiting case in which the originating site S0 includes a broadcast server SD connected to the IP network via a router denoted RO_0, for example. This particular case advantageously corresponds to the situation of a multi-site business for which one of the originating sites S_0 is provided with a broadcast server SD with a large number of customers, the use of a router in this situation being preferable.

With reference to figure 2b, it is indicated that the abovementioned step D can then include a step D1 for the local multicast broadcasting of the information to be broadcast stored at the first address LMD_{0i} from the broadcast server to the router RO_0.

The abovementioned step D1 is followed by a step D2 consisting of a step for redirecting the information to be broadcast ID_{0i} by substituting the second global multicast broadcasting address GMD_{0g} for the first local broadcasting address LMD_{0i}. It will be understood in particular that this redirection step D2 can consist simply in allocating to the information broadcast locally ID_{0i} the second global multicast broadcasting address to in fact generate the data stored at the second broadcasting address, denoted ID_{0g}.

It will be understood, in particular, that the abovementioned redirection step can simply consist in associating with the stored data supporting the information to be broadcast, stored on the router RO_0, a simple data structure comprising the first and the second addresses, the data structure possibly consisting simply of a list containing at least the first and the second abovementioned addresses or any equivalent data structure.

Given the way the method that is the subject of the present invention works as described in figures 2a to 2b, it is indicated that, for a plurality of extended multicast broadcast request messages, relating to one and the same first local multicast broadcasting address, emanating from a plurality of roaming terminals belonging to the originating site and each interconnected to the IP network on a different separate site, the step E consisting in transmitting by global multicast broadcast the information to be broadcast under the second address is then used to

create a global multicast broadcast tree, the root element of which is formed by one of the routers common to the broadcast branches that make up the abovementioned global multicast broadcast tree.

However, a specific embodiment of the method that is the subject of the present invention will now be described in conjunction with figure 2c, this embodiment appearing particularly advantageous for providing a consistent management of the local (or global) multicast information broadcast types and of the memory space ultimately occupied to this end, both on the broadcast server SD and on the router RO_0.

According to a particularly advantageous embodiment of the method that is the subject of the invention, the second global multicast broadcasting address GMD_{0g} is maintained and validated for a local multicast information broadcast LMD_{0i} at the first address permanently. The concept of permanent information broadcast originates from the fact that the global address is maintained as long as there are external subscribers.

In these conditions, it will be understood that to provide the permanent maintenance and validation of the second global multicast information broadcasting address GMD_{0g}, the data structure, such as a list [LMD_{0i}, GM_{0g}], is stored and secured permanently on the router, the first and the second addresses thus being correlated on a one-to-one basis permanently.

In these conditions, the step D consisting in transferring information to be broadcast from the first to the second broadcasting address can then be eliminated for any extended multicast broadcast request message to this second address, following the first

extended IP multicast broadcast request message to the abovementioned second address.

It will be understood in particular that the concept of eliminating the step D simply concerns the elimination of the physical transfer of the data stored at the first address to the second address, this physical transfer then capable of being simply replaced by calling the second global multicast information broadcasting address based on the previously mentioned permanent data structure.

A flow diagram illustrating a corresponding procedure is represented in figure 2c.

With reference to the abovementioned figure, the abovementioned procedure can include, prior to the implementation of the steps A, B, C, D and E of figure 2a, a step O_1 for receiving any extended multicast broadcast request message EMR (LMD_{0i}) and counting these messages, a counting index t being assigned to each of these successive messages in a step O_1. The abovementioned step O_1 is followed by a step O_2 for comparing the counting indices with the value 1.

On a negative response to the test step O_2, the method that is the subject of the present invention as represented in figure 2a is then conducted unchanged.

Otherwise, on a positive response to the test O_2, for any extended multicast broadcast request message to the second address, subsequent to the abovementioned first message, a procedure for calling the permanent data structure in step O_3 is carried out to order a step O_4 for eliminating the step D.

The elimination step can then be represented, as is illustrated in figure 2c, by invoking logical switches

C_1 and C_2, to eliminate the invocation of the step D and, on the contrary, to activate the invocation of the step E directly from the step C and, naturally, of the data and information stored at the first address redirected via the permanent data structure to the second global multicast broadcasting address.

A more detailed description of the structure of the messages implemented by the method that is the subject of the present invention will now be given in conjunction with figures 3a to 3c.

Figure 3a represents a non-limiting data structure representative of an extended multicast information broadcast request message.

As an example, the request message can include a header field containing an extended multicast information broadcast request message EMR identification code, a field containing the first local multicast information broadcasting address LMD_{0i} and a field containing an identification code of the roaming terminal N_{0jk}.

On receipt of the request message by the originating site, the latter is then able to proceed, on the basis of the address references 0, j and k of the roaming terminal identification code, to verify the fact that the latter belongs to the originating site of index 0, to identify as such an identification code represented by the index j and to store the address of the separate site S_k.

Figure 3b represents, by way of nonlimiting example, a structure of a message offering access GMO (GMD_{0g}) to a global multicast information broadcast transmitted by the originating site S_0 to the abovementioned roaming terminal.

As is represented in figure 3b, this message can include a header field containing a code identifying access offer messages GMO, a second global multicast information broadcasting address GMD_{0g}, the indices 0 and g being used to identify the broadcasting source in the originating site. When the message offering access is received by the roaming terminal, the latter is able to identify the broadcasting source corresponding to the information requested by the request message at the local multicast information broadcasting address under the second global multicast information broadcasting address.

Finally, figure 3c represents, in a non-limiting way, the structure of a message accepting the offer of access.

This message can include a header field containing a code identifying access offer acceptance messages AAO, a field containing the second global multicast information broadcasting address, the presence of this information in the access offer acceptance message, that is, the second global multicast information broadcasting address, possibly corresponding to an actual acceptance by the user of the roaming terminal of the proposed access offer.

With reference to figures 3a, 3b and 3c, it is indicated that, preferably but in a non-limiting way, other fields can be added to the message structures. In particular, as is represented in the abovementioned figures, a data signature field SIG1, SIG2 and SIG3 can be added to the abovementioned message structure.

In a specific and non-limiting way, it is indicated that the fields of the abovementioned messages can preferably be transmitted encrypted without departing

from the context of the method that is the subject of the present invention.

When the data fields that make up the structure of the abovementioned messages are encrypted and a signature data field is provided, those involved in implementing the method that is the subject of the invention, that is the originating site and the roaming terminal concerned, can then proceed on the one hand to authenticate the data transmitted via the abovementioned messages by verifying the signatures and to securely transmit the data using the encryption/decryption process.

These operations will not be described in detail because they can be implemented on the basis of any encryption/decryption, signature/verification method that is known per se.

A more detailed description of an extended multicast information broadcasting system according to the subject of the present invention will now be given in conjunction with figures 4a to 4c.

Figure 4a shows a representation of a multi-site entity or business comprising four sites, an originating site denoted S_0 and three separate sites denoted S_1, S_2 and S_3. By way of non-limiting example, the originating site S_0 is deemed to include a broadcast server SD connected to a router RO_0 on the IP network.

Similarly, by way of non-limiting example, the roaming terminal is referenced N_{0j2}, in which 2 represents the address of the site S_2 hosting this roaming terminal in the example given in figure 4a. The local multicast information broadcast is generated by an information broadcasting source located at a first local multicast broadcasting address denoted LMD_{0i} and situated, of

course, on the broadcast server SD in the originating site S_0. By way of non-limiting example, the roaming terminal N_{0j2} is reputed to be connected on the site S_2 via a router RO_2 to the IP network.

As is also represented in figure 4a, the system that is the subject of the invention includes, at least on the originating site, a module A_1 for receiving an extended multicast information broadcast request message, the message EMR (LMD_{0i}) as described previously in the description and represented in figure 3a. This message consequently includes the identification code of the roaming terminal, that is, the code N_{0jk} represented in the abovementioned figure 3a.

The module for receiving the broadcast request message EMR (LMD_{0i}) can be used for the identification of the roaming terminal via the originating site. It will be understood in particular that, on receipt of the abovementioned request message, the originating site, based on the data field containing the identification code of the roaming terminal N_{0jk} can be used, naturally, to identify, by discriminating the indices or address references 0 and j, the identification of the roaming terminal as belonging to the originating site and authorized to run a transaction to access the extended multicast information broadcasting method.

As is also represented in figure 4a, the system that is the subject of the invention includes, on the originating site, a module A_2 for transmitting from this originating site S_0 to the roaming terminal, after the identification of the latter N_{0j2}, the message offering access to a global multicast information broadcast, that is, the message GMO (GMD_{og}). This message is represented according to the structure illustrated in figure 3b, for example.

Furthermore, the originating site includes, as is represented in figure 4a, a module A_3 for receiving the message accepting the offer of access to the information being broadcast at the second global multicast information broadcasting address, transmitted by the roaming terminal N_{0j2}. This message is, for example, as represented in figure 3c.

The originating site S_0 further includes a module A_4 for transferring the information to be broadcast from the first to the second broadcasting address.

It will be understood in particular that the abovementioned module A_4 can be used, for example, to execute the abovementioned transfer in accordance with figure 2b and/or in accordance with figure 2c, given the rank of the request message received relative to the first extended multicast information broadcast request message received.

Finally, the originating system S_0 advantageously includes a module for transmitting, by global multicast information broadcast, information to be broadcast to the second address, that is, the address GMD_{0g} for the data ID_{0g} transmitted by global multicast information broadcast.

In the embodiment of the system that is the subject of the invention as represented in figures 4a to 4c, consideration is given to a non-limiting exemplary embodiment in which the originating site S_0 includes the broadcast server SD connected to the IP network via the router RO_0.

In this situation, the module for receiving the multicast information broadcast message, module A_1, the module for transmitting the message offering access A_2, the module for receiving the acceptance message A_3, the

module for transferring the information to be broadcast from the first to the second broadcasting address A_4, and finally, the module for transmitting by global multicast information broadcast A_5 information to be broadcast under the second address, are formed by software modules located in the router RO_0, this router naturally being provided with appropriate input/output devices dedicated to the transmission and reception of messages according to the IP method over the IP network.

It will be understood in particular that the router RO_0 being provided with a computation unit CPU and a random access memory RAM, the set of modules A_1 to A_5 of software type can be stored in a mass memory of the router, loaded into the RAM type working memory and configured as a software agent for implementing the steps of the method that is the subject of the invention as represented in figures 2a to 2c.

When, according to a second non-limiting embodiment of the system that is the subject of the invention on the originating site S_0, the broadcast server SD is formed by a dedicated machine, the latter is connected to the IP network in the absence of a router via a network card, for example.

A more detailed description of a roaming terminal equipped to implement the extended multicast information broadcasting method, in accordance with the subject of the present invention, such as the roaming terminal N_{0j2} on the site S_2 of the figure 4a, will be provided prior to a description of the procedure of the system that is the subject of the invention with reference to the figures 4a to 4c.

The roaming terminal such as the terminal N_{0j2} in the figure 4a includes at least, stored in the mass memory

of the latter, as represented in figure 5, a software module B1 for creating and transmitting an extended multicast information broadcast request message, that is, the message EMR (LMD_{0i}) represented in figure 3a, a software module B_2 for receiving and reading the message offering access GMO (GMD_{0g}) as represented for example in figure 3b, and, finally, a software module B_3 for creating and transmitting to the originating site S_0, via the IP network, the message AAO accepting the offer of access to the information being broadcast at the second global multicast information broadcasting address as represented in figure 3c.

Of course, the roaming terminal includes a computation unit CPU and a RAM type random access memory. The abovementioned software modules can then be loaded into the random access memory RAM to execute the message invocation and interpretation functions, as described previously in the description in conjunction with figures 2a to 2c.

Figure 5 shows a non-limiting exemplary representation of the roaming terminal as formed by a laptop computer, for example.

Of course, in addition to the abovementioned software modules B_1, B_2 and B_3, the roaming terminal includes any input/output and network connection system such that the roaming terminal, such as the terminal N_{0j2} represented in figure 4a on the site S_2, is connected to the IP network via a router RO_2. The existence of a router is not essential, but corresponds to most of the situations commonly encountered.

Finally, although the roaming terminal is represented in figure 5 in the form of a laptop computer, this roaming terminal can in fact be any terminal, such as a pocket PC or other, provided with sufficient resources.

Furthermore, the concept of roaming terminal advantageously covers the use of any fixed terminal provided with a code for accessing the extended multicast information broadcasting services, this code being, for example, temporary and managed by the broadcast server SD located on the originating site S_0.

The way the system as represented in figure 4a works is then as follows with reference to figures 4a, 4b and 4c:

The roaming terminal N_{0j2} is, for example, visiting on the site S_2 and wants to have access and, for example, subscribe to the local broadcast on the originating site S_0, the address of which is LMD_{0i}.

The roaming terminal N_{0j2} which has in mass memory, for example, the local multicast broadcasting address LMD_{0i}, detects that it is a broadcast restricted to the originating site S_0.

The abovementioned roaming terminal then proceeds to send an extended multicast information broadcast request message to the software agent AL_0 located on the router RO_0 of the originating site S_0, instead of sending a conventional type IGMP subscription message. This request message is the one sent in the step A of figure 2a. The software agent AL_0 is, for example, formed by the abovementioned software modules A_1 to A_5 run via the RAM memory and the computation unit CPU represented in figure 4a.

The software agent AL_0 of the originating site S_0 receives the abovementioned request message. After the identification of the roaming terminal, as described previously in the description, the originating site S_0, via the abovementioned software agent, transmits the

access or subscription offer message GMO (GMD_{0g}). This subscription offer message indicates in fact to the roaming terminal that, to receive the broadcast restricted to the originating site S_0 on the separate site S_2, the roaming terminal must accept the offer and subscribe in fact to the global multicast broadcast, the address of which is the second address GMD_{0g}.

In fact, with reference to the provisions of the standard RFC 2236, it is indicated that the second abovementioned global multicast information broadcasting address is an address corresponding to a global multicast broadcast or restricted to the organization for which the access router on the originating site S_0 is identified as being the source.

When the roaming terminal N_{0j2} receives the message offering access, it normally accepts the access offer or subscribes to the information broadcast at the second global multicast information broadcasting address by sending the acceptance message AAO to its access router, the router RO_2 represented on the site S_2 of figure 4a.

This access acceptance or subscription message is then propagated through the IP network in point-to-point mode as mentioned previously in the description.

When the extended multicast information broadcast request message for the broadcast data at the local multicast information broadcasting address concerned is the first of these request messages, the negative alternative of the comparison test O_2 in figure 2c, for example, the access router on the originating site S_0 itself accesses or subscribes to the local broadcast at the address LMD_{0i} restricted to the originating site S_0, in order, of course, to receive its data or information ID_{0i}. After receipt of the message accepting access to

the global multicast information broadcast at the second address GMD_{0g}, the access router RO_0 of the originating site S_0 proceeds via the software agent and, in particular, via the software module A_4, with the operation to redirect this information and corresponding data according to the step D_2 in figure 2b. The operation to transmit global multicast data and information in accordance with the step E of figure 2a or 2c by the originating site S_0, and in particular by the software module A_5 located in the router RO_0, to the roaming terminal N_{0j2}, is then carried out. The abovementioned roaming terminal visiting on the site S_2 then receives the data of the local broadcast from the first address via the global broadcast at the second address.

The configuration of the system that is the subject of the networked invention is then that represented in figure 4a, the branch of the multicast broadcast tree being represented by the access router RO_0 of the originating site S_0, an intermediate router ROx of the interconnecting multicast IP network and another intermediate router ROy of this same interconnecting multicast IP network, which is linked to the access router RO_2 of the roaming terminal and of the separate site S_2.

With reference to figure 4b, consideration is now given either to the same roaming terminal of identification index or code j, or another roaming terminal of identification index or code l, but belonging to the same originating site S_0 visiting on the separate site S_1.

For the purposes of the description, another roaming terminal of specific identification code or index l is considered, that wants to access or subscribe to the

same local broadcast of the originating site S_0 and of the same address LMD_{0i}.

As in the case of the roaming terminal N_{0j2}, the other roaming terminal N_{011} detects that it is a broadcast restricted to the originating site S_0.

The other roaming terminal transmits an extended multicast broadcast request message to the software agent located on the access router RO_0 of the originating site S_0.

This message indicates the address LMD_{0i} of the broadcast concerned.

The software agent located on the router RO_0 of the originating site receives the abovementioned extended multicast information broadcast request message and, after the identification of the other roaming terminal, transmits the access or subscription offer message GMO (GMD_{0g}).

Since the extended multicast information broadcast is already in progress, no other action is undertaken by the access router RO_0 of the originating site S_0. In practice, with reference to figure 2c and in which $t > 1$, that is to say, the positive alternative of the comparison operation O_2, the rank of the extended multicast information broadcast request message being greater than 1, the simple invocation of the permanent data structure in the step O_3 is then used to invoke the step O_4 to eliminate the step D. The method that is the subject of the invention, as represented in figure 2c, can then be used, via logical switches C_1 and C_2, to go direct from the step D to the step E.

When the roaming terminal N_{011} receives the message offering access, it responds with the access or

subscription offer acceptance message at the second broadcasting address by sending the acceptance message AA0 in the form of IGMP subscription to the access router RO_1 of the separate site S_1. Since the global multicast information broadcast at the second broadcasting address is already in progress in the IP network, in particular on the intermediate router RO_x, a new branch of the broadcast tree is thus created, which consists, by way of non-limiting example, in the interconnection of the intermediate router RO_x and of a router RO_z in turn connected to the access router RO_1 of the separate site S_1.

The roaming terminal N_{011} thus receives the data of the local broadcast at the address LMD_{0i} via the global broadcast at the second address GMD_{0g}.

The state of the networked system that is the subject of the invention is as represented in figure 4b.

Finally, one of these roaming terminals or another different roaming terminal of identification index or code m proceeds, as represented in figure 4c, to transmit an extended multicast information broadcast request from the separate site S_3, for example; the process is similar to that described in relation to the separate site S_1, the step D of the figure or of the figure 2c still being eliminated. The networked system that is the subject of the invention in this situation corresponds to that represented in figure 4c, the broadcast tree further including an additional branch made up of the intermediate router RO_z and RO_w of the IP network, for example, connected to router RO_3 of the separate site S_3.

It will thus be understood, from looking at figures 4a to 4c, that the system that is the subject of the invention allows for an extended multicast type

information broadcast from the broadcasting source SD to the final receiver without any use of unicast type tunnels or even the systematic duplication of the data.

Thus, for each broadcast that is the subject of an extended multicast information broadcast request, in accordance with the subject of the present invention, from a roaming terminal, the method that is the subject of the invention is used to generate the creation of a multicast broadcast tree on the interconnecting IP network.

Although the security aspect of access control and of access to the broadcast information such as the process for identifying each roaming terminal, encrypting data and authenticating data are not a subject of the present invention, it is indicated that the abovementioned data identification, authentication and encryption processes can be used to implement a particularly advantageous extended multicast data broadcast method.

Finally, the invention relates, naturally, to any software product stored on a storage medium for the implementation, by a computer such as a roaming terminal, for example, of the extended multicast information broadcasting method described previously in the description based on a local multicast broadcast on an originating site to at least one separate site hosting this roaming terminal and linked to this originating site by the IP network.

Since the local multicast information broadcast is generated by an information broadcasting source located at a first local multicast information broadcasting address in the originating site, the software product includes, for invocation on the roaming terminal, the software module B_1 for creating and transmitting an

extended multicast information broadcast request message. This request message naturally contains at least the first local multicast information broadcasting address LMD_{0i} and an identification code of the roaming terminal concerned N_{0jk}, a software module B_2 for receiving and reading the message offering access to a global multicast information broadcast, message GMO (GMD_{0g}) including at least the second global multicast information broadcasting address GMD_{0g}, the broadcasting source of which is identified in the originating site, and a software module B_3 for creating and transmitting to the originating site S_0 the message accepting the offer of access AAO to the information being broadcast at the second global multicast information broadcasting address GMD_{0g}.

The invention also relates to a software product stored on a storage medium for the implementation, by a computer, of the multicast information broadcasting method extended from a local multicast broadcast on an originating site S_0 to at least one separate site S_k hosting this roaming terminal and linked to this originating site by the IP network. The software product includes, for invocation on the originating site S_0, a software module A_1 for receiving the extended multicast information broadcast request message sent by the roaming terminal from the separate site, this software module A_1 being used for the identification on the separate site of the roaming terminal by the originating site via address indices or references 0, j and k assigned to the identification codes of the roaming terminal, a software module A_2 for transmitting from the originating site to the roaming terminal a message offering access to the global information multicast broadcast. This message offering access includes at least the second global multicast information broadcasting address GMD_{0g}, the broadcasting source of which is identified in the originating site,

a software module B_3 for receiving the message accepting the offer of access to the information being broadcast at the second global multicast information broadcasting address sent by the roaming terminal, a software module B_4 for transferring the information to be broadcast from the first to the second broadcasting address, this software module B_4 possibly being simply to create the permanent data structure previously mentioned in the description and, of course, redirect the information to be broadcast from the first to the second address with these addresses in a one-to-one correlation, a software module A_5 for transmitting by global multicast information broadcast the information to be broadcast to the abovementioned second address.